Environmental Regulation

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The Problem

Tragedy of the commons (Hardin, 1968)

Common-pool resources subject to ruin

We all have incentives to use resources but private gains hold social or ecological costs

Benefits gained by individual, costs borne by all

Incentive to put more cattle on the commons as long as personal gain is more than personal cost

- Examples: fisheries and climate change

Main issues with Tragedy of the Commons

Misinformation issues

- Difficulty to measure our impact on the environment
- assumptions of stability
- Example fisheries: What happened? We sent ships but there is no catch?

Delay in control response

- Unfeasibility of unilateral control measures
- Free riding issue even if everyone agrees with objective of common resource protection

Limited time horizon

- Policy makers (short time horizon)
- Changes might occur across several generations

The solutions?

Reduce Information problems

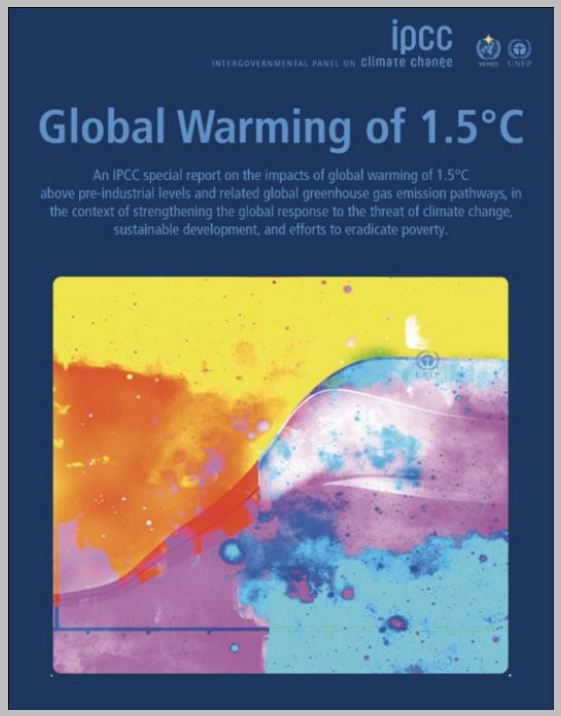
- Need a to have information about resource depletion
- Criterion of judgment on common resource versus private benefit. Weighting system.
- Example: information disclosure policies (eco-labels)

Establish Property rights

- Examples: Partition the seas, Establish quotas
- Cap and Trade

Why is climate change a good example of the tragedy of the commons?

Climate Change



Selected impacts	1.5°C	2.0°C	2°C impacts
Global population exposed to severe heat at least once very 5 years	14%	37%	**2.6x** worse
Number of ice-free artic summers	At least one every 100 years	At least one every 10 years	**10x** worse
Reduction in maize harvest in tropics	3%	7%	**2.3x** worse
Further decline in coral reefs	70-90%	99%	Up to **29%** worse
Decline in marine fisheries	1.5 M tonnes	3 M tonnes	**2x** worse

Source: WRI Infographic of IPCC Special Report on 1.5 Degrees, 2018

Main issues with Climate Change

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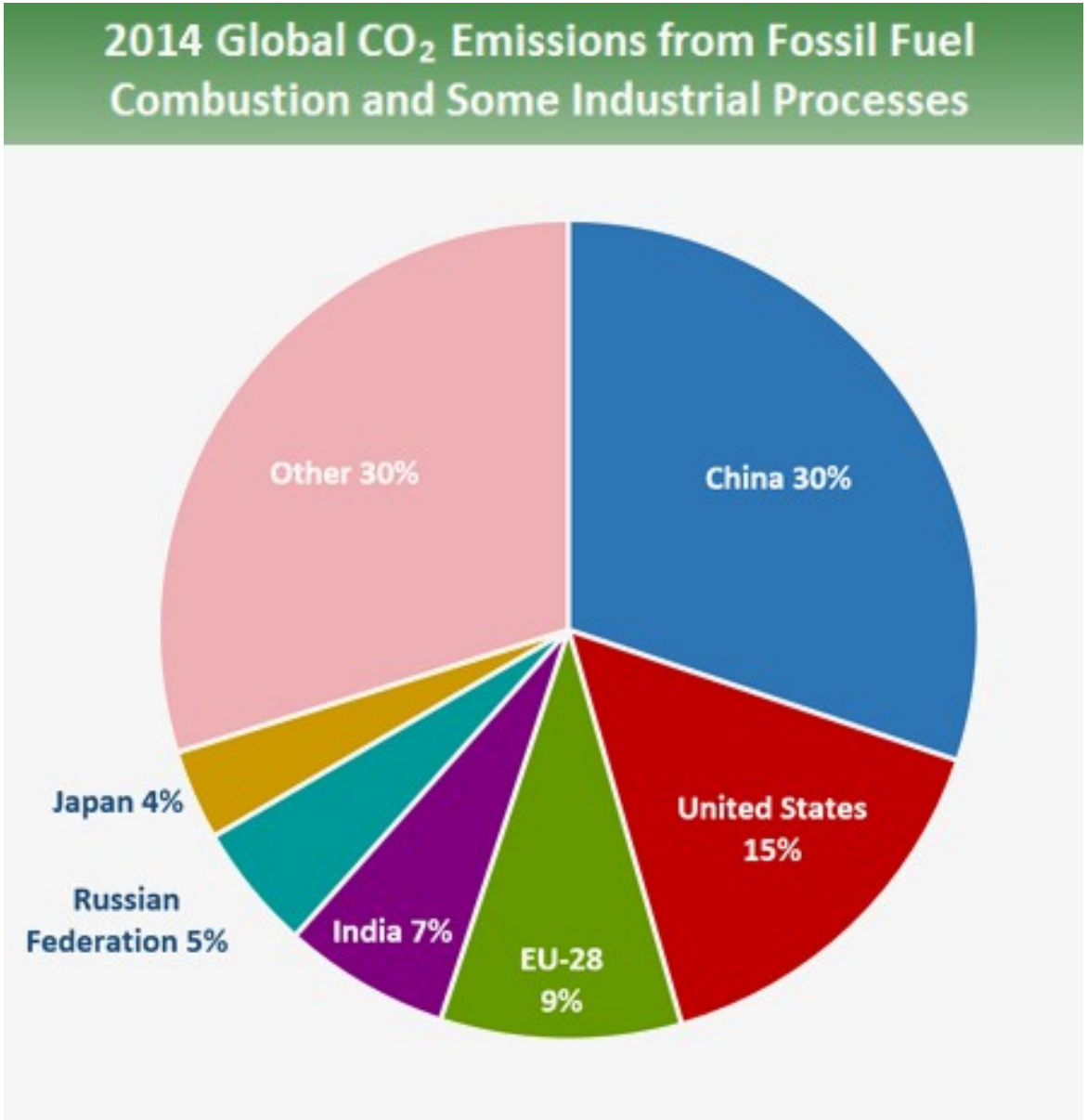

2014 Global CO_2 Emissions from Fossil Fuel Combustion and Some Industrial Processes
Other 30%
China 30%
United States 15%
EU-28 9%
India 7%
Russian Federation 5%
Japan 4%

Different types of environmental regulation/policies

Command and control
- Permit system

Market based instruments
- Taxes
- Tradable permits

Information based regulations/Programs
- TRI
- Eco-labeling programs (LEED)

Command and control / Direct regulation

Laws prescribing objectives, standards and technologies polluters must comply with

Examples:

- Emission or discharge standard
- Process standard

Strengths and Weaknesses of CC

Advantages of command and control

- No search and information cost about the technology to use
- Easy monitoring

Disadvantages of command and control

- Static and lacks incentives
- Time lag before new technologies are embodied in CC regulations

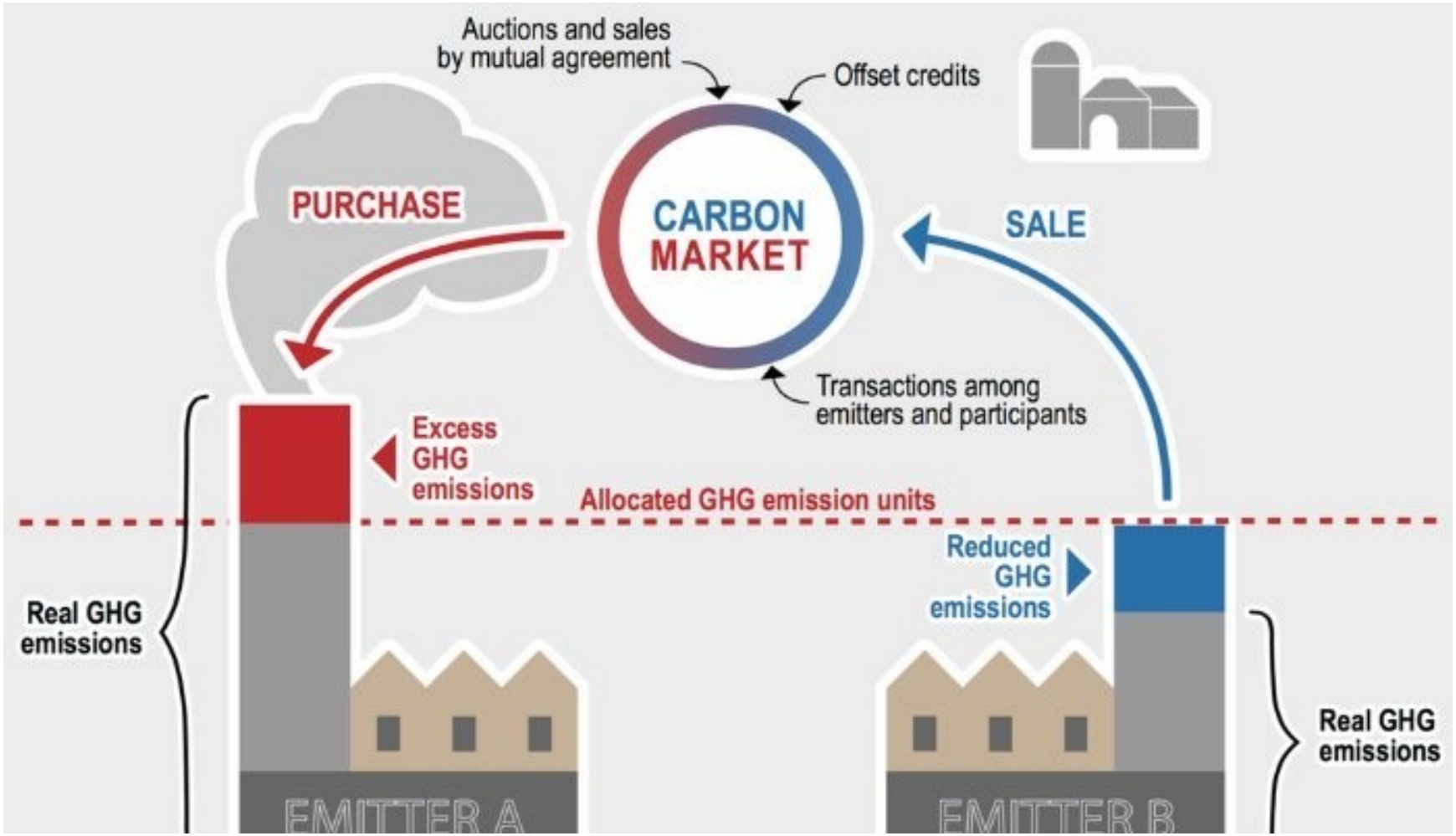
Cap and trade

Cap and Trade

- Governments distribute or sell ‘pollution permits’ corresponding to the total amount of tolerable or allowable pollution.
- Permits can be sold and purchased on the market
- Example RECLAIM SAQMD

Mary Nichols, Chair Air Resources Board (1)

https://www.youtube.com/watch?v=fON7t5DPQbk (3:40 min)


Auctions and sales by mutual agreement
Offset credits
PURCHASE
CARBON MARKET
SALE
Transactions among emitters and participants
Excess GHG emissions
Allocated GHG emission units
Reduced GHG emissions
Real GHG emissions
Real GHG emissions
EMITTER A
EMITTER B

Traditional Approach

30% mandatory reduction

Before	Before
600 tons	400 tons
After	After
420 tons	280 tons
Factory A Reduction $50 per ton	**Factory B Reduction $25 per ton**
180 tons reduced	120 tons reduced

Total Emissions Reduced: 300 tons

Cost to Reduce: $12,000

Cap and Trade Approach

Before	Before
600 tons	400 tons
After	After
500 tons	200 tons
Factory A	**Factory B**
100 tons reduced	200 tons reduced

Total Emissions Reduced: 300 tons

Cost to Reduce: $10,000

30% mandatory reduction	Price per ton	Tons before	Tons after	Tons reduced	Price reduction
Factory A	50	600	420	180	$ 9,000.00
Factory B	25	400	280	120	**$ 3,000.00**
Total					$ 12,000.00

Cap and Trade						($25)	($30)	($50)
Factory A	50	600	500	100	$ 5,000.00	$ 7,000.00	$ 7,400.00	$ 9,000.00
Factory B	25	400	200	200	**$ 5,000.00**	$ 3,000.00	$ 2,600.00	$ 1,000.00
Total					$ 10,000.00			
Factory B sells 80 at $25					$ 2,000.00			
Factory B sells 80 at $30					$ 2,400.00			
Factory B sells 80 at $50					$ 4,000.00			

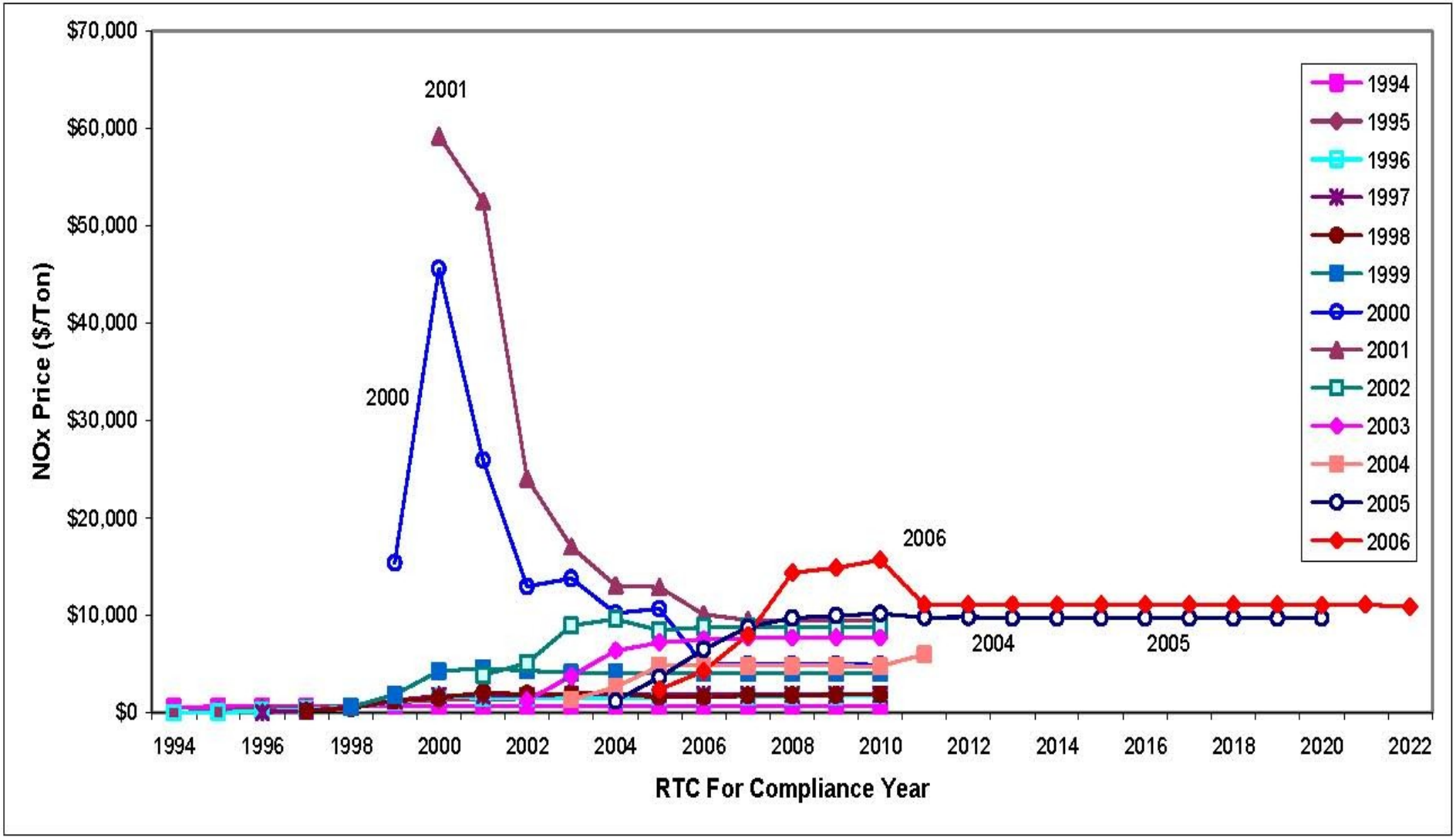
Current Emissions trading systems

- U.S. Acid Rain Program
- EU Trading Program
- SAQMD RECLAIM Program
- California Cap and Trade

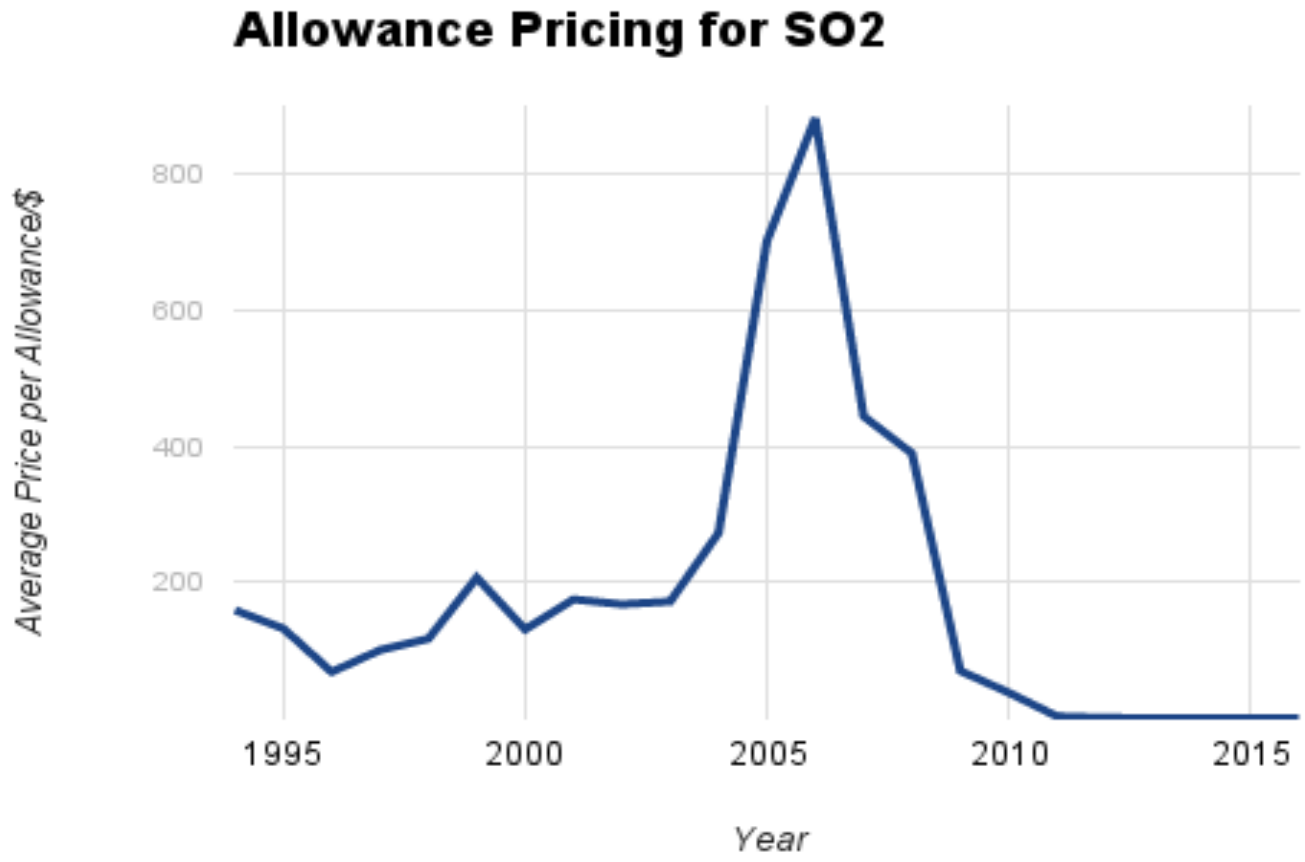
thing that surprised you in the cap and trade system you studied?

	US Acid Rain Program	EU Emission Trading	RECLAIM	California Cap and Trade
Date of creation	1995	2005	1993	2013
Industries involved	Fossil-fuel power plants	Energy activities, production and processing of ferrous metals, mineral industry, pulp, paper and board activities	Electric utilities, oil refineries, petrochemical plants, aerospeace, foundries, glass processing, breweries, cement manufacturing	Various industries
Number of participants in 2008	2,000 + plants	Over 12,000 installations	30,000 permitted companies	450+ entities
How was baseline established	Title IV of the Clean Air Act set a goal of reducing annual SO2 emissions by 10 million tons below 1980 levels	Vary by industry	Designed to reduce emissions of NOx by 70% from 1994 to 2003	Participating companies must reduce their aggregate emissions by 6% by 2010
Price of credits 2009	$150 per ton	averaged €20 per ton (initial) to of €0.10 per	$10,000 Sox to $40,000 Nox	…

Yearly Average Prices for NOx RTCs 1994 through 2006



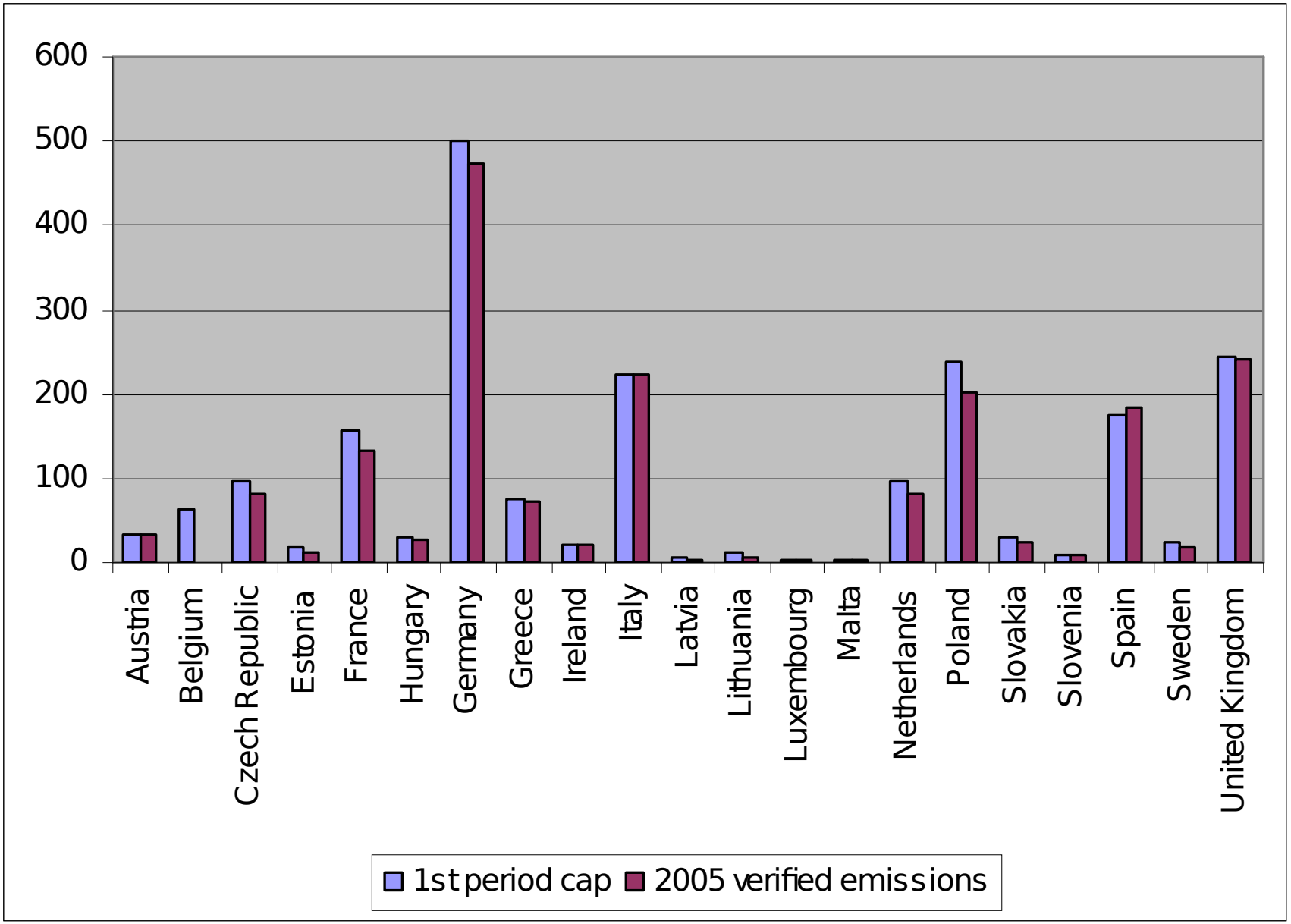
U.S. Acid Rain Program



Emission certificate prices have only started to rise in the past two years

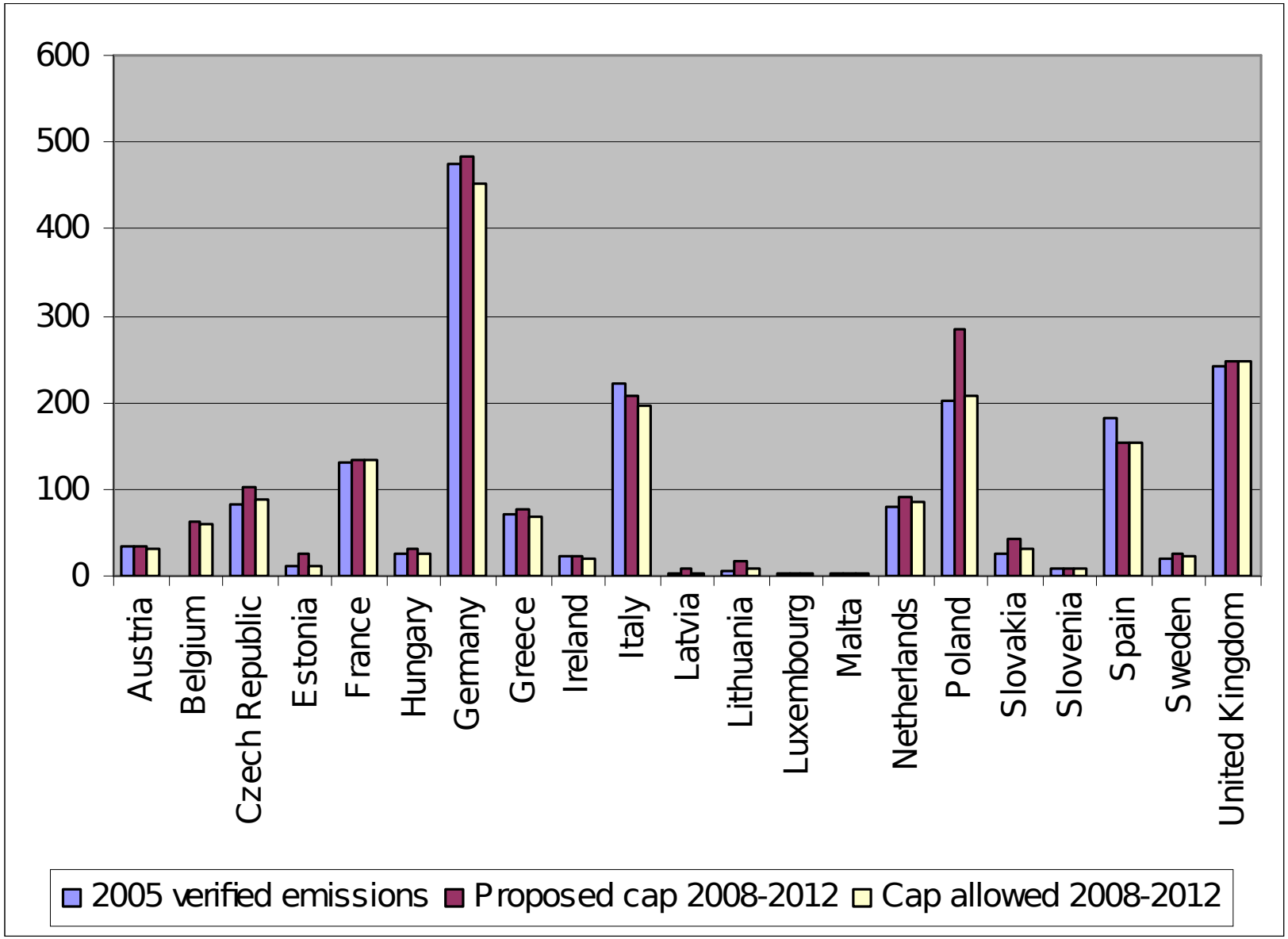
Price of EU emissions certificates over time

Source: European Environment Agency, Sandbag.org.uk



All quantities are in units of Million Metric Tonnes of CO2

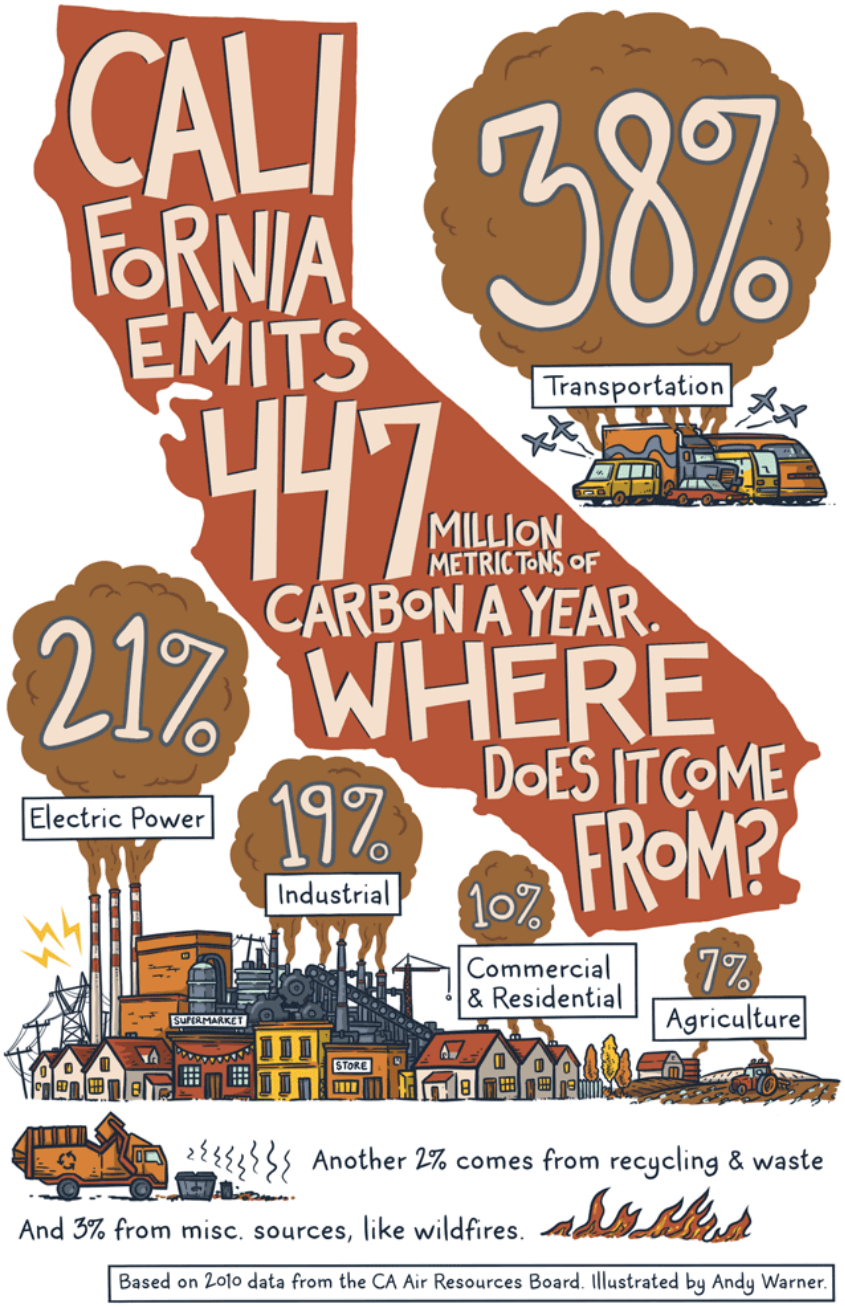
Source: EU press release IP/07/459:



All quantities are in units of Million Metric Tonnes of CO2
Source: EU press release IP/07/459:

Mary Nichols, Chair Air Resources Board (2)

http://www.youtube.com/watch?v=KPrthKX4KTA&feature=results_main&playnext=1&list=PLE73B522F2A751B55 (5:05 min)


CALIFORNIA EMITS 447 MILLION METRIC TONS OF CARBON A YEAR. WHERE DOES IT COME FROM?
38%
Transportation
21%
Electric Power
19%
Industrial
10%
Commercial & Residential
7%
Agriculture
SUPERMARKET
STORE
Another 2% comes from recycling & waste
And 3% from misc. sources, like wildfires.
Based on 2010 data from the CA Air Resources Board. Illustrated by Andy Warner.

California Cap and Trade

1990 levels by 2020

15% reduction to what would be in place

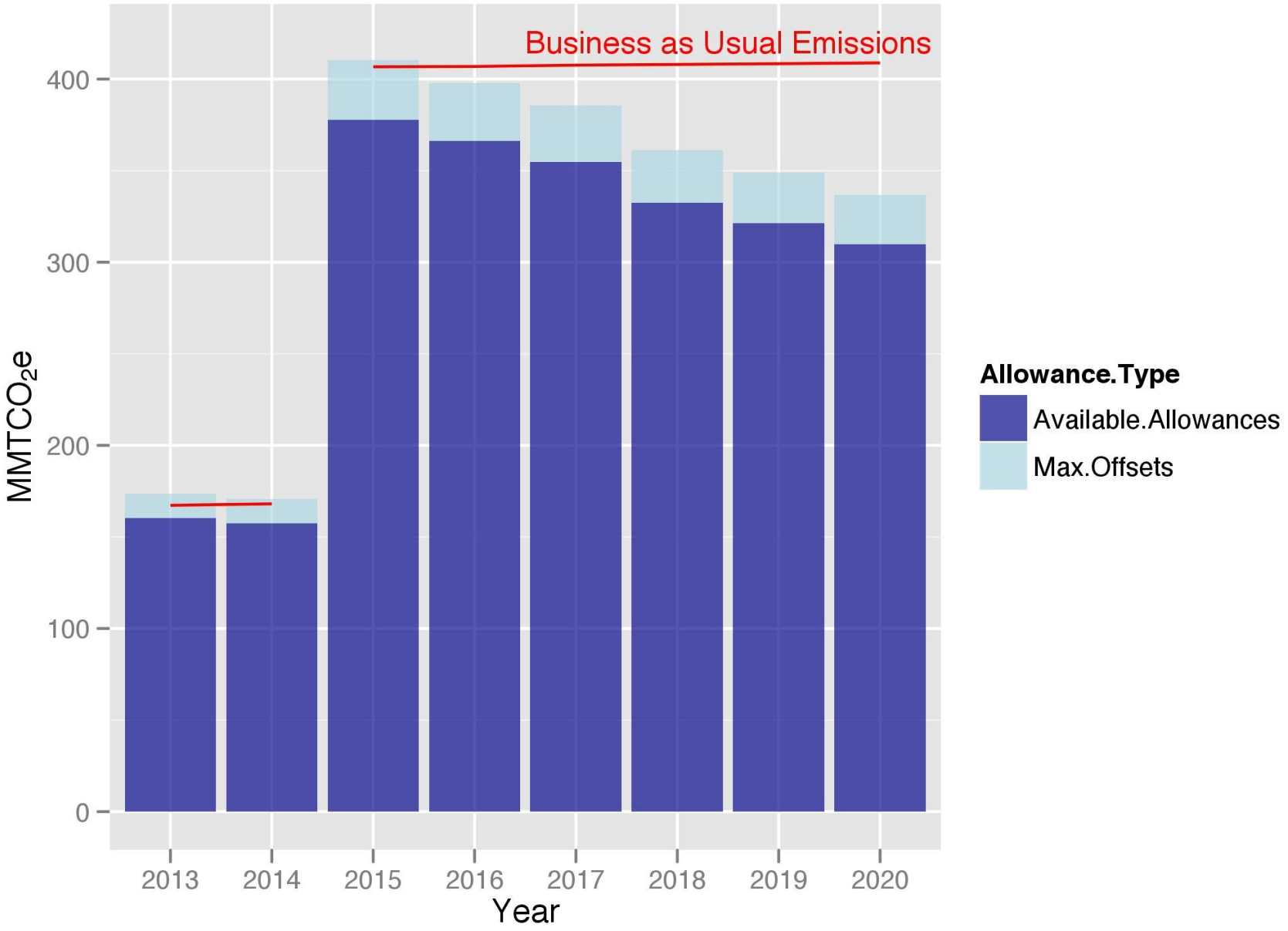
360 businesses and 600 facilities

First compliance period (2013):

- Electricity generation, including imports
- Large industrial facilities that emit over 25,000 metric tons CO2e per year

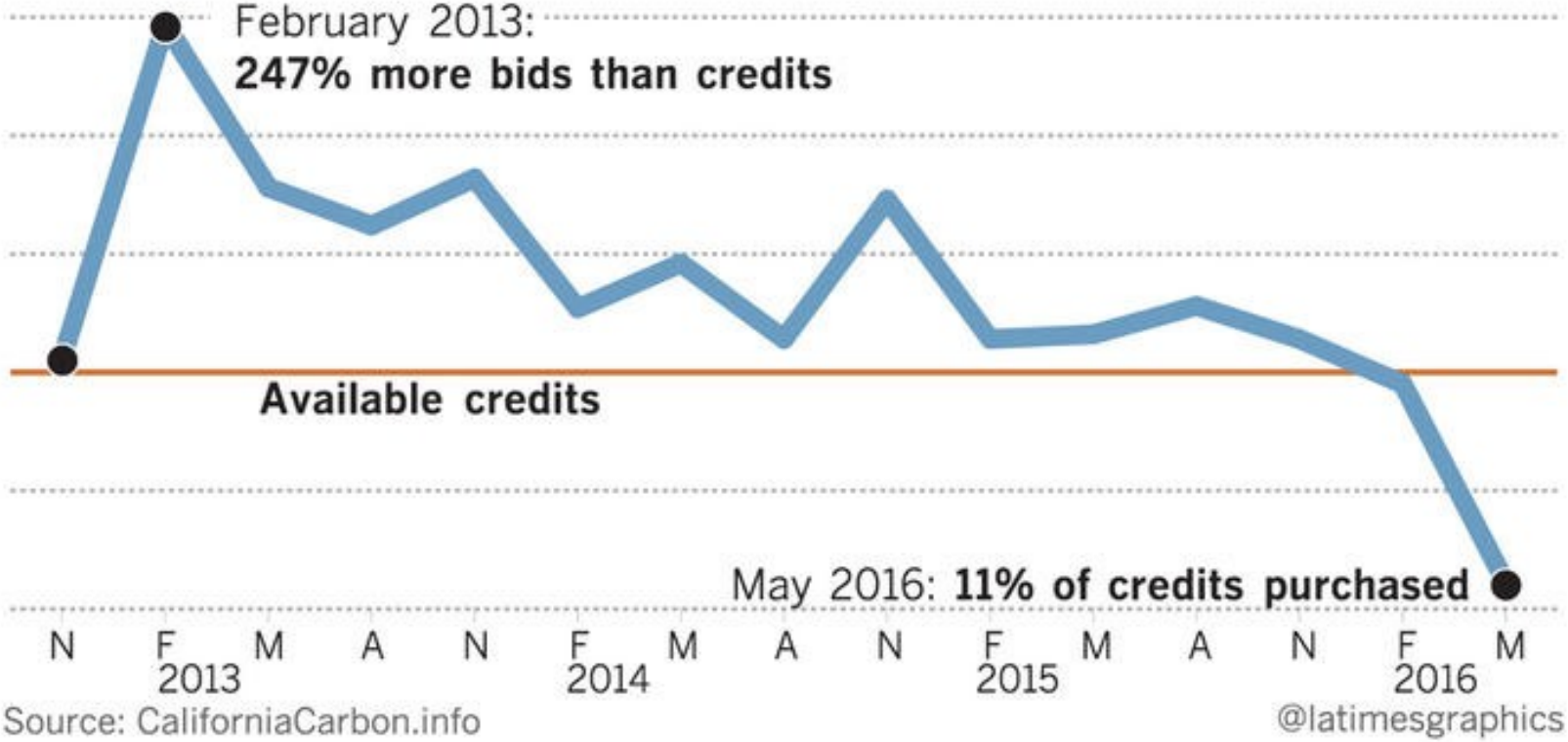
Second period (2015)

- Distributors of transportation fuels, natural gas and other fuels


Business as Usual Emissions
400
300
200
100
0
MMTCO2e
2013
2014
2015
2016
2017
2018
2019
2020
Year
Allowance.Type
Available.Allowances
Max.Offsets

Falling demand for carbon permits

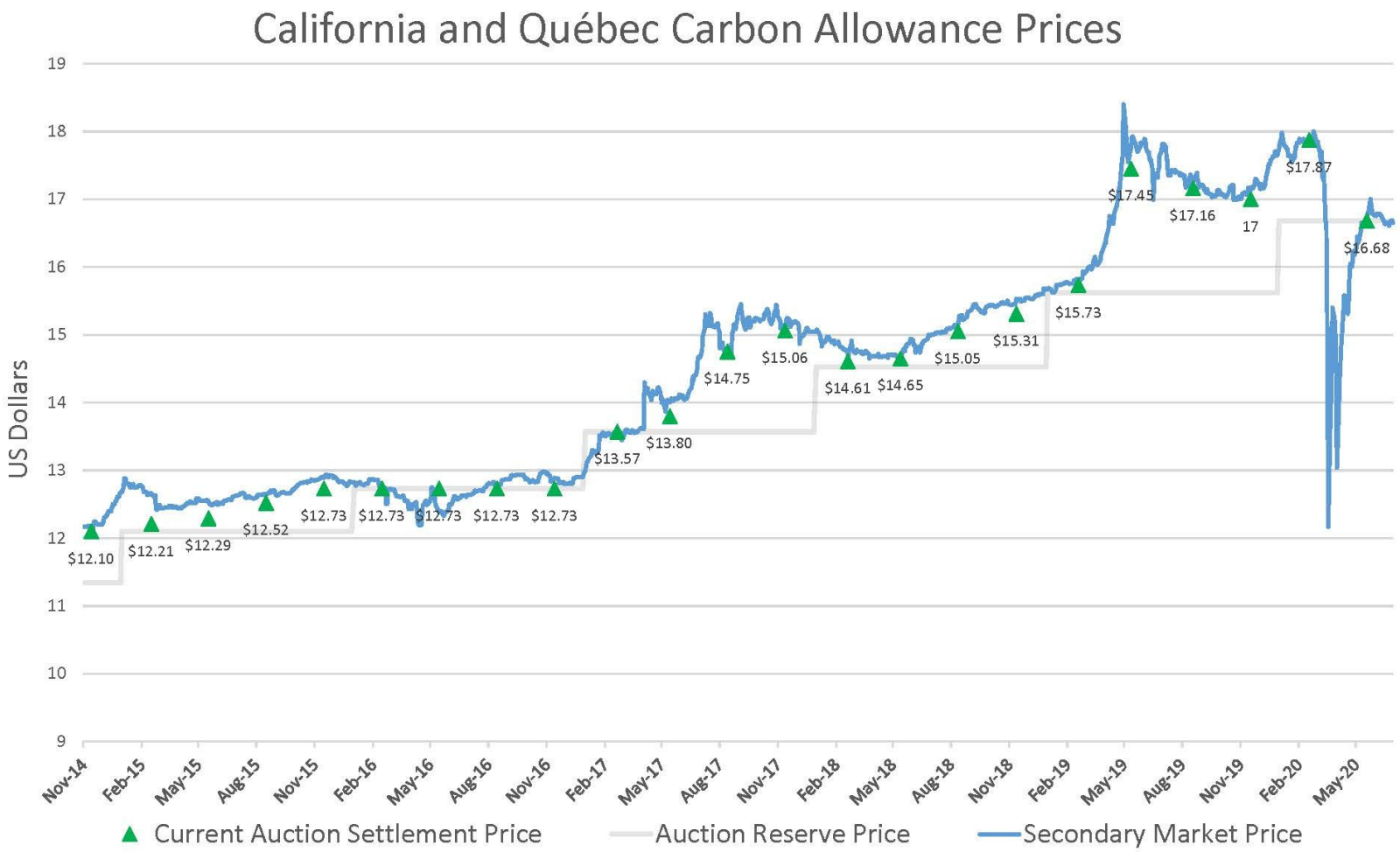
In early auctions, demand for permits far outstripped supply. But in the last auction in May, only 11% of the permits were sold.



Source: CaliforniaCarbon.info

@latimesgraphics

Posted July 6, 2020



Notes:

1. California and Québec held their first joint auction in November 2014.
2. Current Auction Settlement Price is the price at which current vintage allowances sold at auction.
3. Auction Reserve Price is the minimum price at which allowances can be sold at auction.
4. Secondary Market Prices are a composite of commodity exchange futures contract prices for near month delivery and a survey of OTC brokered transactions for California Carbon Allowances. Secondary market prices are provided with permission of Argus Media Inc.
5. Secondary Market Price data drawn on July 1, 2020.

CALIFORNIA
AIR RESOURCES BOARD

Strengths and weaknesses of tradable permits

Strengths:

- Total Q of pollution is fixed ex if new plant comes, price of credit increases
- Possibility to make profit

Difficulties:

- Need to be able to measure pollution accurately
- Initial allocation of permits…Grandfathering
- Distributive implications of permits
- Transaction costs
- Search and information costs about which technology to use and whether to invest or buy credits

Coverage and distribution of emissions obligations

Sectoral coverage

Allocation methods

Commitment periods

New entrants and closure provisions

Comparable stringency and mechanisms for compliance

Stringency of emissions caps

Governance and enforcement systems

Compliance penalties and procedures

Banking and borrowing provisions

Offset rules and policies

Registry systems

Social cost of carbon (SCC)

SCC is an estimate, in dollars, of the economic damages that would result from emitting one additional ton of greenhouse gases into the atmosphere.

The SCC puts the effects of climate change into economic terms to help policymakers and other decision makers understand the economic impacts of decisions that would increase or decrease emissions.

The SCC is currently used by local, state, and federal governments to inform billions of dollars of policy and investment decisions in the United States and abroad.

How is SCC calculated?

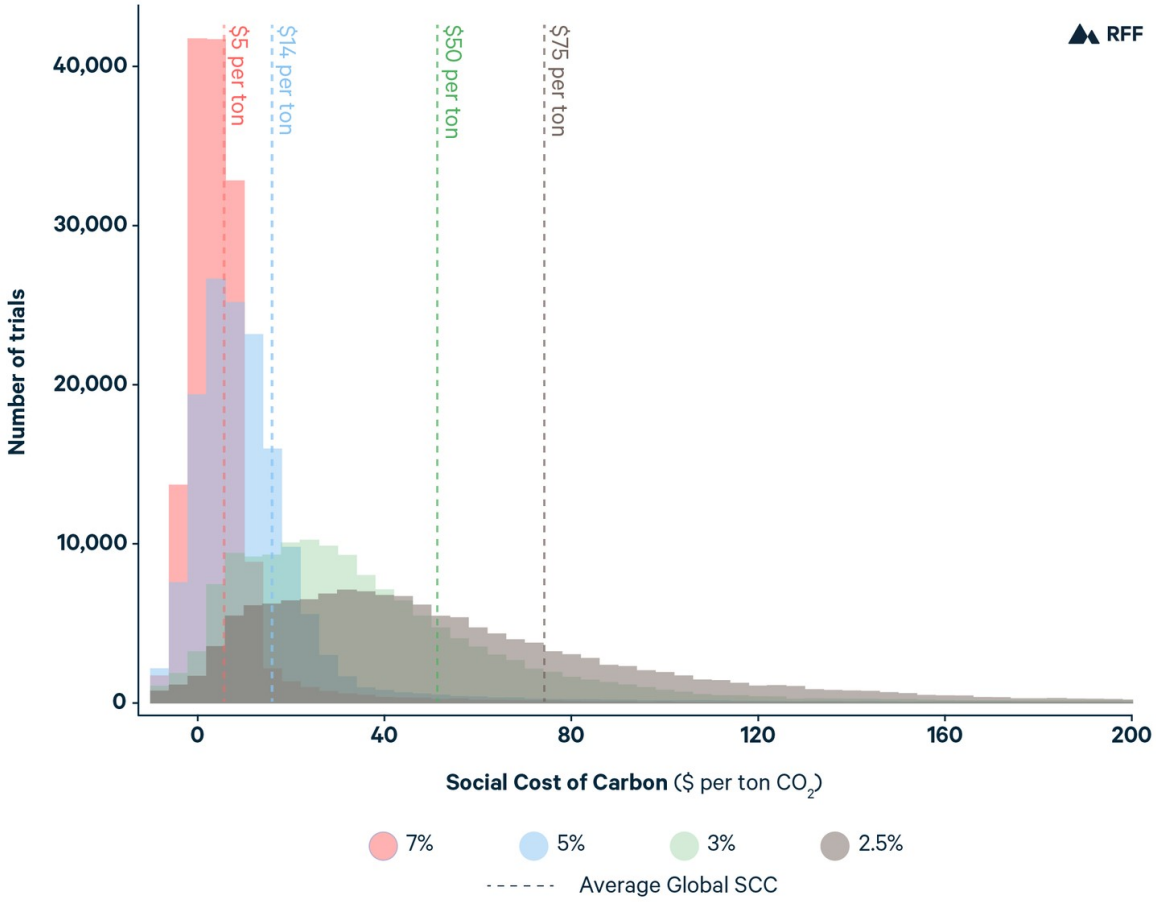
Step 1: Predict future emissions based on population, economic growth, and other factors.

Step 2: Model future climate responses, such as temperature increase and sea level rise.

Step 3: Assess the economic impact that these climatic changes will have on agriculture, health, energy use, and other aspects of the economy.

Step 4: Convert future damages into their present-day value and add them up to determine total damages.

What is the current evaluation of SCC?



Science Based Targets Initiative

Science Based Targets is a joint initiative by CDP, the UN Global Compact (UNGC), the World Resources Institute (WRI) and WWF intended to increase corporate ambition on climate action by changing the conversation on GHG emissions reduction target setting and creating an expectation that companies will set targets consistent with the level of decarbonisation required by science to limit warming to less than 1.5ºC / 2°C compared to pre-industrial temperatures.

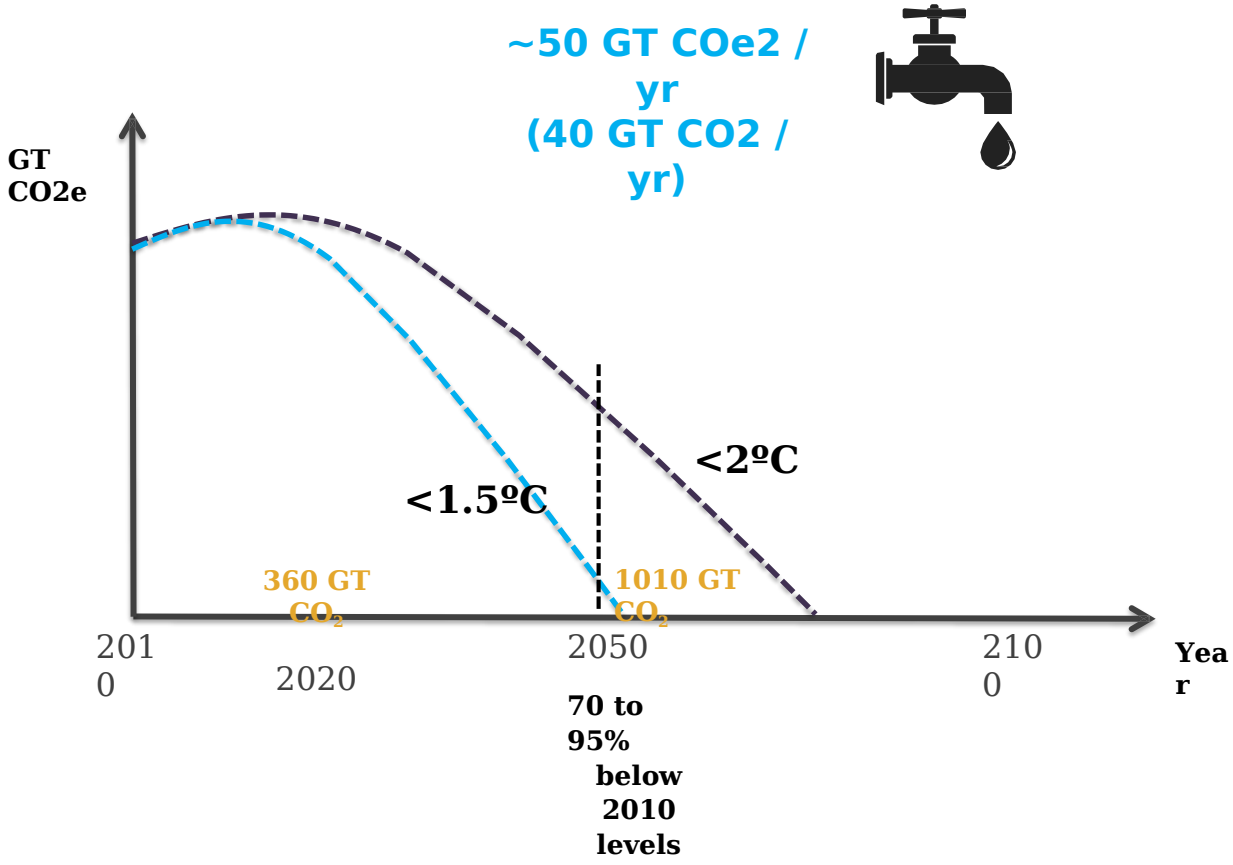
CDP DRIVING SUSTAINABLE ECONOMIES

THE GLOBAL COMPACT

WORLD RESOURCES INSTITUTE

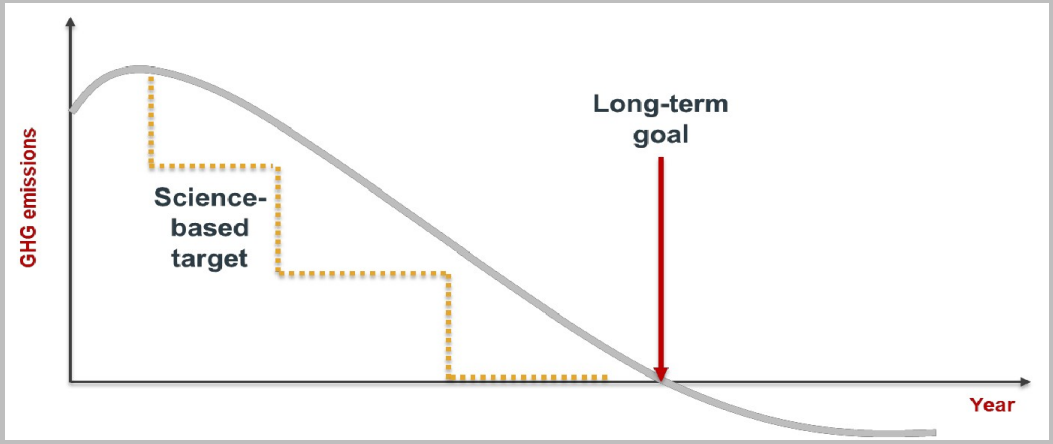
WWF

Understanding emission trajectories



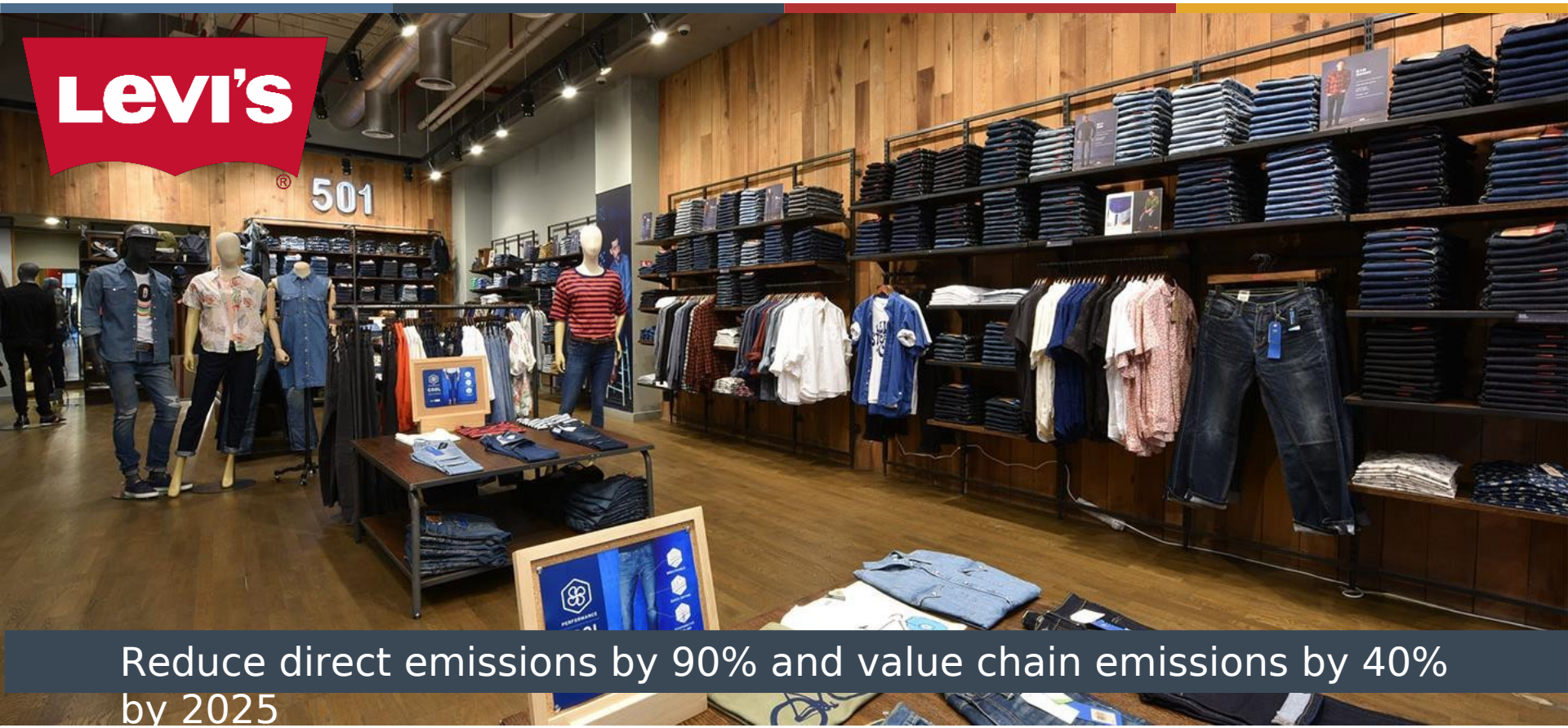
What are science-based targets?

"GHG emissions reduction targets that are consistent with the level of decarbonization that, according to climate science, is required to keep global temperature increase within 1.5 to well-below 2ºC compared to pre-industrial temperature levels"



SCIENCE BASED TARGETS
DRIVING AMBITIOUS CORPORATE CLIMATE ACTION

Achieve zero carbon emissions at its breweries by



Reduce direct emissions by 90% and value chain emissions by 40% by 2025

the average product by 70% by 2030

500+ companies

~20% of Fortune 500

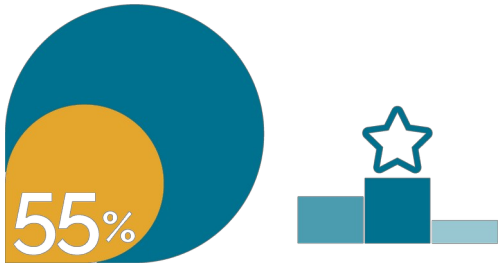
39 countries

US$10+ trillion

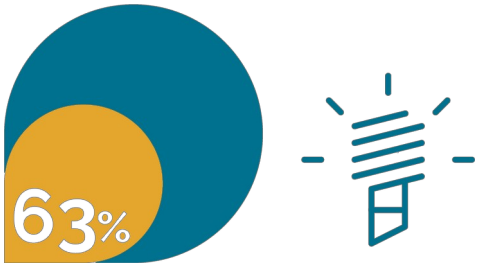
~900 MT CO_2e

Market transformation objective

Why many companies commit to **Science Based Targets**



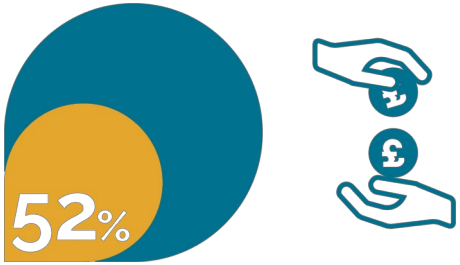
OF COMPANY EXECS **HAVE GAINED COMPETITIVE ADVANTAGE** FROM SETTING SCIENCE-BASED TARGETS



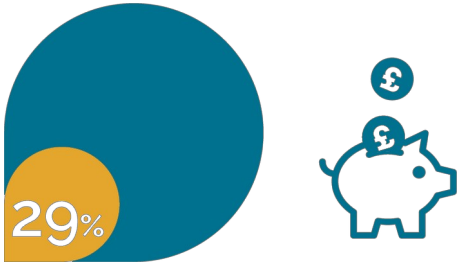
OF COMPANY EXECS SAY SCIENCE-BASED TARGETS **DRIVE INNOVATION**

OF COMPANY EXECS HAVE **INCREASED REGULATORY RESILIENCE** THANKS TO SBTs

OF COMPANY EXECS **HAVE SEEN THEIR BRAND REPUTATION BOOSTED** FROM SETTING SCIENCE-BASED TARGETS



OF COMPANY EXECS HAVE SEEN **INVESTORS CONFIDENCE BOOSTED** BY SCIENCE-BASED TARGETS



OF COMPANY EXECS HAVE SEEN **BOTTOM LINE SAVINGS** FROM SCIENCE-BASED TARGETS

Conclusion

Market based mechanisms have a potential to effectively mitigate Climate Change but devil is in the details

- Need to have facilities with different cost of abatement

- Need to have clear boundaries and those to be sufficiently big to avoid the tragedy of the commons

- Complex implementation

- Risk of adverse effect for underprivileged communities

- Resources gained from Cap and Trade can be redistributed to underpriviledged communities and investments in cleaner economy

Thursday

Discussion of final project

https://public.tableau.com/app/profile/open.for.good.platform